

PROTOZOAN FAUNA OF A LIMESTONE SINKHOLE IN NORTH-CENTRAL FLORIDA

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The protozoan fauna of the Devil's Mill Hopper, a deep limestone sinkhole located in R19E, T9S, Section 15 in Alachua County, has not been reported previously. The Mill Hopper, which is near the center of a mesic hammock surrounded by turkey oak-pine flatwoods, is approximately 115 feet deep with steep, but well-vegetated, slopes from which numerous small springs issue about one third of the way down the slope. The flow from the springs tumbles down over exposures of Hawthorn limestone to a pool which was approximately 50-75 feet in diameter at the time of this study. The pool is bordered during low water levels by low banks of accumulated silt. The springs and their runs are virtually devoid of conspicuous organic matter; the pool under average conditions has a moderate amount of algae around its margin as well as a number of aquatic invertebrates and small fish. In addition to the main spring runs, a much smaller volume of water trickles down over the rocks adjacent to the runs and subsequently over the large number of liverworts (*Dumortiera hirsutum*) and mosses (Amblystegium group of the family Hypnaceae) which are growing on them.

MATERIALS AND METHODS

Water samples were taken from three different microhabitats in order to increase the comprehensiveness of the survey and to allow for ecological comparisons. Where possible a small amount of the detritus was collected with the water. Water temperature was measured with a Taylor fishing thermometer; pH was approximated with a Taylor colorimetric pH indicator. The first sample was obtained November 16, 1958, from a spring run about 3 feet from the point where it emerges from the hillside. No aquatic vegetation was present. The water temperature was 69° F; the pH was slightly basic.

The second sample was also collected November 16, 1958. It consisted of a sample of the liverworts and mosses previously mentioned plus some of the substrate. These were partially immersed

in water obtained by placing the jar beneath a liverwort over which water was trickling. Neither water temperature nor pH were determined.

The last sample was taken from the edge of the pool on January 4, 1959. Due to flooded condition following heavy rain, it was impossible to obtain a bottom sample. The water temperature was 67° F; the pH was slightly basic.

The samples were examined approximately twice a week from November 18 until December 11, 1958, and from January 6 to January 13, 1959. Species identifications were made by means of reference to Hall (1953), Hoogenraad and deGroot (1940), Jahn (1949), Kahl (1935) and Kudo (1954).

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RESULTS

Forty-three forms of protozoa were identified at least to genus and in most cases to species. These represent 16 mastigophorans, 8 sarcodinans, and 19 ciliophorans. No sporozoans were present in the samples. In the following list of species (S) indicates presence in the spring run, (L) indicates presence on the liverworts and mosses, and (P) indicates presence in the pool.

Subphylum Mastigophora

Monas guttula Ehrenburg (P); *Monas* sp. No. 1 (L); *Monas* sp. No. 2 (S).

Oikomonas termo Lemmermann (P) 5-6 μ .

Cyathomonas truncatum Ehrenburg (S).

Astasia longa Pringsheim (L); *A.* cf. *dangeardi* Lemmermann (L) 25 μ ; *A. torta* Pringsheim (L); *Astasia* sp. No. 1 (L) 22-31 μ ; *Astasia* ? sp. No. 2 (L) 5 μ .

Entosiphon sulcatum Dujardin (S).

Bodo caudatus Dujardin (S); *B. edax* Klebs (S); *B. minima* Klebs (S).

Pleuromonas jaculans Perty (P).

Retortomonas ? sp. No. 1 (L).

Subphylum Sarcodina

Acanthamoeba ? sp. (L)¹.

Centropyxis constricta Ehrenberg (S, L) 30-112 μ ; *C. platystoma* Penard

(L) 70 μ . *Diffugia oblonga* Ehrenburg (L); *D. globulosa* Dujardin (L) 34 μ ;

D. cf. *curvicaulus* Penard (L) 56 μ . *Trigonopyxis arcula* Leidy (L) 33 μ .

Trinema lineare Penard (L) 36 μ .

¹ Represented by a cyst 8 μ in diameter.

Subphylum Ciliophora

- Chilodonella turgidula* Penard (P) 30 μ ; *C. caudata* Stokes (P).
Coleps nolandi Kahl (S).
Paramecium nephridiatum von Gelei (L); *P. trichium* Stokes (L).
Trichopelma sphagnetorum Levander (L).
Homalogastra setosa Kahl (L) 17 μ . *Malacophrys rotans* Kahl (S).
Tetrahymena pyriformis Ehrenburg (S); *Tetrahymena* sp. No. 1 (S); *T. vorax* Kidder, Lilly, and Claff (L)² 30.
Philaster ? sp. No. 1 (L).
Ctedoctema acanthocrypta Stokes (L) 20 μ . *Cyclidium* sp. No. 1 (L)³ 22 μ .
Metopus sp. No. 1 (P).
Aspidisca sp. No. 1 (L).
Holosticha sp. No. 1 (P). *Oxytricha* ? sp. No. 1 (S).
Vorticella sp. No. 1 (L).

In addition the liverwort-moss sample contained a small (15 μ) unidentifiable ciliate which possessed a prominent "gullet" and lateral groove.

DISCUSSION

There are three striking features about the protozoan fauna of the Mill Hopper: (1) the distinct differences in the composition of the population for the three microhabitats, *Centropyxis constricta* being the only species found in more than one (the genus *Monas* was present in all three samples but was represented by a different species in each); (2) the small size of the great majority of individuals; (3) and the very low population density. The first two features are noted under Results; the latter is discussed below. The ecological data gathered was insufficient to postulate the underlying causes.

Population density is expressed here as an index in terms of individuals per slide examined (I/S). Population density was lowest in the spring run sample. *Entosiphon* and *Bodo minima* were the most abundant species, appearing about once every three slides examined (I/S = .33). The two other species of *Bodo* had an index of .13, and the remaining eight species were observed only once (.07).

Astasia longa (17.8) and *Cyclidium* were extremely abundant in the liverwort-moss sample. Approximately half a dozen *Cyclidium* were visible in the microscopic field at all times, the great number

² Saprozoic form.

³ Observed actively ingesting bacteria. One individual was undergoing cell division.

involved rendering an index impractical. Other indices in order of decreasing abundance were: *Paramecium nephridiatum*, .44; *P. trichium* and *Diffugia globulosa*, .33; *Centropyxis constricta*, .22; and the remainder, .11.

Oikomonas (3.7) and *Chilodonella caudata* (2.1) predominated in the pool sample. Each of the five other species had an index of .14.

Future investigations should concentrate on developing techniques for discovering the nature of the ecological dissimilarities of the different microhabitats.

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